A Synopsis

Of the proposed thesis entitled

‘Mixed Convection Flows In Vertical Double Passage channel’

Submitted to the

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For the Degree of

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In

Mathematics

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Submitted by

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Under The Guidance of

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1. Introduction:

The study of mixed convection flows in vertical double passage channel and concentration of the fluid are of great importance so the component of fluids and fluid saturated porous medium has attracted considerable interest in recent years because of its importance in many practical fields such as chemical engineering, geothermal, oil recovery technique and biological process. It is also of practical interest in heat removal the extraction of geothermal energy and more specifically in understanding the mechanism of transfer of heat from aquifers in the deep interior of earth to shallow depths. In a mixed convection flow the free and forced convections are having comparable magnitude. So in this situation both forced and free convection happens simultaneously which means mixed convection occurs, where the effect of forced flow on buoyant flow is notable.

In this research work effective mixed convection flow in a vertical double passage channel containing permeable fluid will be studied analytically using method of solution. The subject of channel flow has been investigated extensively, few studies have to far evaluate for these effect.

2. Review of Literature:

Combined heat and mass transfer by free convection under boundary layer approximations has been studied by Bejan and Khair (1985), Lai and Kulacki (1991) and Murthy and Singh (1999). Coupled heat and mass transfer by mixed convection in Darcian fluid saturated porous media has been analyzed by Lai (1971). The free convection heat and mass transfer in a porous enclosure has been studied by Angirasa et al. (1997). The combined effects of thermal and mass diffusion in channel flows have been studied by Nelson and Wood (1986, 1989), Das et al. (1994) have studied the effect of mass transfer on the flow past impulsively started infinite vertical plate in presence of wall heat flux and chemical reaction**.** Recently many investigations have been focused on the baffle walled channel heat exchangers. Most studies discussed the optimal baffle geometry that enhance heat transfer performance for a given pumping power or flow rate. In the experimental efforts Whitelaw (1981) used LDA to deduce the velocity field in an asymmetric heat exchanger with baffles on the shell side surface.

The techniques of mixed convection flows enhance heat transfer is an important objective in numerous engineering applications of the micro and nano fluids including pumping systems, chemical catalytic reactors, electronic system cooling, plate-fin heat exchangers, etc. Moreover, the arrangement of baffles may be used to cool down the temperature in the passage for the thermally developed flow. When the channel is divided into several passages by means of plane baffles, as usually occurs in heat exchangers or electronic equipment, it is quite possible to enhance the heat transfer performance between the walls and fluid by the adjustments of each baffle position and strengths of the separate flow streams. In such configurations, perfectly conductive and thin baffles may be used to avoid significant increase of the transverse thermal resistance. Stronger streams may be arranged to occur within the passages near the channel wall surfaces in order to cool or heat the walls more effectively. Even though the subject of channel flow has been investigated extensively, few studies have so far evaluated for these effects. Recently, Prathap Kumar et al. (2011a, 2011b) and Umavathi (2011) analyzed the free convection in a vertical double passage wavy channel for both Newtonian and non-Newtonian fluids. A mechanical model of liquid sloshing was developed by Xu and Dai (2003) to investigate the longitudinal dynamic characteristics of partially filled liquid cargo tank vehicles during typical straight line driving.

Thus, as one might expect, the resultant techniques are powerful and applicable to a wide variety of fluid mechanical circumstances that require engineering judgment.

3. Objectives of Research:

To study the mixed convection flows in vertical double passage channel for fluid in different circumstances. A plane baffle may be used as an insert to enhance the rate of heat transfer in the channel. A thin perfectly conductive baffle is used so as to avoid a considerable increase in the transverse thermal resistance into the channel. Presence of the baffle may lead to a higher value of Nusselt number according to the baffle position and the value of the Grashof number. In this study, the effects of baffle size, position were studied for internal cooling heat transfer augmentation. The plane baffle is to induce cross flow for higher heat transfer coefficients and hence improved heat transfer performance, this objective is not quite achieved in conventional shell and tube heat exchanger.

4. Methodology:

First of all we have to study different type of fluids and the governing equations for velocity, temperature and concentrations and their properties.

The basic governing differential equations of the flow and heat transfer are solved using the following techniques.

1) Power Series Method.
2) Regular Perturbation method.
3) Finite Difference Method.
4) Shooting Method.

Study of the effects at different positions of baffle, of different media and fluids will be done by graph which will be plotted using the programming software.

5. Importance of Study:

The purpose of our study focuses on the fully developed convection flow in a vertical double passage channel in the presence of first order chemical reaction, at different baffle positions, which are considered so as to extensively investigate their distinct influence on the velocity, temperature, concentration, velocity gradient and volumetric flow and rate of heat transfer. The idea of mixed convection is to enhance heat flow. The important objective is in numerous engineering application of nano fluids and micro fluids such as pumping systems; chemical catalytic reactors plate fin heat exchangers, electronic cooling system etc.

The growing need for chemical reactions in chemical and hydrometallurgical industries requires the study of heat and mass transfer in presence of chemical reactions. There are many transport processes that are governed by the simultaneous action of buoyancy forces due to both thermal and mass diffusion in presence of chemical reaction effect.

The study of mixed convention fluid got much attention in last several years due to traditional Newtonian fluid that precisely describe the properties of fluid flow for a fluid having suspended particles in vertical double passage channel.

6. Proposed Work Plan/Formulation and Structure of Study:

Year wise plan and target to be achieved.

1. **First Year :**

In the first year the researcher tries to buildup the necessary background, the area of research and getting a broad view about research work. Researcher surveys the literature related to research topic and will collect material for research such from research journals, books, research articles, Online sources, different solve and unsolved problems etc. And learn the programming software to get the graphs. Also researcher will participate to national, international conferences, workshops, seminars etc. The researcher meets the prominent mathematicians to discuss and verifying his finding. Submit the progress report to the university.

Second Year:

The outcomes of our research will be presented in the national and international conferences throughout this year also publish the outcomes in reputed journals and submit the final synopsis to the university.

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